

CLAIMS

WHAT IS CLAIMED IS:

1. A multiple beam electron inspection system for inspecting a sample, the system comprising:

5 a first and a second thermal field emission source to generate a first and a second incident electron beam to be used in inspecting a sample;

two polepieces positioned to generate a magnetic focusing field that operates to focus the first and the second incident electron beams towards a first and second portion of the sample respectively;

10 a first and second detector to detect respectively a first and a second detection electron beam output from the sample that result from the first and the second incident electron beams impinging on the first and second portion of the sample; and

a deflector for directing the first and the second incident electron beams towards the first and second portion of the sample and directing the first and second detection electron beams output from the sample towards the detector.

2. The inspection system recited in claim 1 wherein the deflector is configured to generate a uniform electrostatic deflection field.

3. The inspection system recited in claim 1 wherein the deflector comprises at least two deflector plates configured to generate an electric field across the first and second incident electron beams and the first and second detection electron beams.

4. The inspection system recited in claim 2 wherein the deflector is DC biased to guide secondary electrons from the first and second detection electron beams onto the first and second detector.

5. The inspection system recited in claim 2 wherein the deflector is modulated with an AC signal to electronically scan the first and the second incident electron beams across a first and second portion of the sample.

5 6. The inspection system recited in claim 2 further comprising an electrode to generate a retarding field to accelerate the first and second detection electron beams and to enhance the signals generated from the first and second detector.

7. The inspection system recited in claim 2 wherein a pair of deflector plates are used to provide uniform deflection forces on a row of incident electron beams containing at least a first and a second incident electron beam and a row of detection
10 electron beams containing at least a first and a second detection electron beam.

8. The inspection system recited in claim 2 wherein the first and second detectors are part of an array of detectors arranged in rows.

9. The inspection system recited in claim 5 further comprising a stage to mechanically move the sample with reference to the first and second incident electron
15 beams.

10. The inspection system recited in claim 2 wherein the first and second incident electron beams are part of a plurality of incident beams arranged in rows.

11. The inspection system recited in claim 10 wherein the rows are staggered.

12. A method for measuring a characteristic of a sample using an apparatus
20 that includes a first and second thermal field emission source, two polepieces, a first and second detector, and a deflector comprising:

causing a first and a second thermal field emission source to generate a first and a second incident electron beam to be used in inspecting a sample;

focusing the first and the second incident electron beams towards a first and second portion of the sample respectively using two polepieces positioned to generate a uniform magnetic focusing field;

deflecting the first and the second incident electron beams towards the first and second portion of the sample and deflecting a first and second detection electron beams output from the sample towards the detector using a deflector; and

sensing respectively a first and a second detection electron beam output from the sample that result from the first and the second incident electron beams impinging on the first and second portion of the sample by using a first and second detector.

13. The method recited in claim 12 wherein the deflector comprises at least two deflector plates configured to generate a uniform electric field across the first and second incident electron beams and the first and second detection electron beams.

14. The method recited in claim 12 further comprising using a retarding field to decelerate a first and a second incident electron beam and to accelerate the first and second detection electron beams towards the first and second detectors.

15. A computer program product comprising:

a computer readable medium having computer program instructions stored within the at least one computer readable product configured to cause a device to be programmed to perform the steps of:

causing a first and a second thermal field emission source to generate a first and a second incident electron beam to be used in inspecting a sample;

focusing the first and the second incident electron beams towards a first and second portion of the sample respectively using two polepieces positioned to generate a uniform magnetic focusing field;

deflecting the first and the second incident electron beams towards the first and second portion of the sample and deflecting a first and second detection electron beams output from the sample towards the detector using a deflector; and

sensing respectively a first and a second detection electron beam output from
5 the sample that result from the first and the second incident electron beams impinging on the first and second portion of the sample by using a first and second detector.

16. The computer program product recited in claim 15 further programmed to use a retarding field to decelerate a first and a second incident electron beam and to accelerate the first and second detection electron beams towards the first and second
10 detectors.

17. The computer program product recited in claim 15 further configured to cause the deflecting through the use of a deflector to generate a uniform electric field across the first and second incident electron beams and the first and second detection electron beams.